STYLUS ANTENNA

BACKGROUND OF THE INVENTION

1. The Field of the Invention

The present invention relates generally to antenna structures coupled to digital devices. More specifically, the present invention applies to an antenna with a retracted position and an extended position, where the digital device continuously receives RF signals regardless of the antenna position.

2. The Prior State of the Art

Antenna structures, predominantly used for wireless communication, efficiently transmit and receive electromagnetic energy in the form of radio waves. Antenna structures are used whenever it is impractical, or impossible to use a physical connection, such as a transmission line or waveguide. In order to get the best performance out of the wireless antenna, the antenna must not be obstructed by anything within its path of radiation. Conventional antennas used to connect a digital device to a wireless communication system or cellular telephone are typically placed externally from the digital device because of the noise, interference, obstruction and shielding caused by the various components of the digital device. In particular, conventional antennas do not function correctly if they are obstructed or shielded by the housing or other structures of the digital device.

Conventional antennas are also generally rigid and they protrude a relatively long distance from the body of the digital device. These protruding antennas are often large, unwieldy, aesthetically unpleasing and they make the digital device difficult to move and transport. In addition, these antennas are often bent, broken, knocked out of alignment or otherwise damaged because they can easily catch or strike foreign objects such as people, walls, doors, etc. Further, these known antennas require a large support structure to secure the antenna to the housing of the digital device and this support structure requires a considerable amount of space inside the body of the digital device. This space is very valuable, especially in small, portable digital devices. Additionally, the support structure is often damaged when the antenna is accidentally moved.

It is known that the repair and replacement of conventional antennas and the associated support structure is difficult and costly. In fact, the entire antenna assembly is often removed and replaced instead of attempting to repair a portion of the antenna or support structure. Thus, the repair and replacement of the antenna and/or antenna support structure is expensive and time consuming.

In order to alleviate these problems, many known antennas are often removed before the digital device is moved or transported. Other known antennas implement a retraction system where the antenna can be retracted into the antenna support structure when not in use. Additionally, known antennas must often either be retracted or removed before the digital device can be inserted into its carrying case. Disadvantageously, this requires additional time and resources to either retract and extend or remove and reattach the antenna each time the digital device is moved. Additionally, the removable antenna is often misplaced, lost or damaged when it is detached from the digital device. Further, because the user often does not want to take the time and effort to remove or forgets to retract the antenna, the digital device is moved with the antenna still extended and attached to the digital device and this frequently results in the antenna being damaged or broken.

In certain wireless applications, the user model requires that some connectivity be maintained at all times. In the case

of a retractable antenna, the performance of the antenna may degrade when it is in the retracted position. As discussed previously, small digital or electronic devices such as PDAs, PCMCIA cards, laptop computers, and other wireless enabled digital devices employ an extendable antenna that can be optionally retracted into their respective packages. In this retracted position, the antenna will perform very poorly, if the antenna performs at all, due to the physical and environmental changes of the antenna introduced by the retracted position in, on, or around the antenna structure.

Traditionally, antenna design attempts to achieve good impedance matching to the feeding transmission line so as to maximize the available power for radiation. Unfortunately, the retraction of the radiating element from the extended position in the retractable antenna, discussed above, causes a change in the characteristic impedance of the antenna, resulting in an unmatched impedance between the retracted antenna and the feeding transmission line. This mismatch in the impedances lowers the available power for radiation, thereby decreasing the size of the radiation pattern. The unmatched impedances also amplify the effect of noise and other interference on the desired signals making the operation of the antenna in the retracted position too unreliable.

Antenna design also attempts to achieve the best compromise between the various constraints imposed on the desired radiation pattern. Optimization of the radiation pattern may include maximizing the radiation in one direction and suppressing it in others. If a specific desired radiation pattern is difficult or impossible to obtain using a single antenna, antenna engineers will often resort to designing arrays of simple antennas. Adjustment of the amplitude and phase of the feed voltages to the various elements in the array, as well as the geometrical arrangement of these elements, often achieves the desired radiation characteristics. Unfortunately, antenna array design is complicated by the mutual interaction between the various elements in the array and the operating environment of the array. This is the case of the retractable antenna described above.

Most of the retractable antenna structures are actually two antennas in one antenna array. The antenna structure is primarily composed of a monopole antenna that slides up to an extended position and in the retracted position the antenna structure secondarily uses a coil antenna that is often disguised as a nub at the top end of the monopole antenna. In the retracted position, the antenna structure disables the monopole antenna and engages the coil antenna. So the retractable antenna structure actually uses two different antenna types integrated into one component.

Other digital devices utilize two separate antennas as part of the continuous wireless solution. This configuration contains one antenna that is retractable, which disconnects from the RF feed when retracted. The other antenna is in constant contact with the RF feed and must be considered and accounted for during any adjustment of the amplitude and phase of the feed voltages to the antenna array to achieve the desired radiation characteristics. Additionally, two antennas can be more costly and may not fit within the limited space available in the small electronic devices such as PDAs, laptop computer, PCMCIA cards, or other wireless enabled portable digital device.

SUMMARY OF THE INVENTION

The present invention has been developed in response to the current state of the art, and in particular, in response to these and other problems and needs that have not been fully or completely solved by currently available antennas for